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(54) BURNER

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(74) PO

(57) CLAIM

1. A burner wherein a combustion air passageway from a first set of register vanes to a burner throat is divided into outer and inner passageways;
and a second set of register vanes controllable independently of said first set of register vanes are disposed in said outer or inner passageways.

COMMONWEALTH OF AUSTRALIA

Patents Act

COMPLETE SPECIFICATION

(ORIGINAL)

Class Int. Class

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Lodged:

Complete Specification Lodged:
Accepted:
Published:

Priority:

Related Art:

APPLICANT'S REF.: Case 387

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Complete Specification for the invention entitled:

"BURNER"

Title of the Invention:

BURNER

Abstract of the Disclosure:

A burner provided with first and second sets of air register vanes wherein the pattern of combustion air flows at a burner throat or the shape of the flame may be varied over a wide range depending upon the conditions of combustions, and the manipulation of the burner is simple because the second vanes are usually held open and only the first register vanes may b easily automatically or remote controlled on the fuel ignition and extinction process of burners.

Detailed Description of the Invention:

The present invention relates to a coal, gas, liquid fuel burner for a boiler for generating electricity or an industrial boiler.

Nitrogen oxides NOx produced by the combustion with coal, gas, liquid fuel burners cause at present serious atmospheric air pollution problems, but so far successful methods and apparatus for completely removing nitrogen oxides from any flue gases have not been proposed yet. Under these circumstances, the next best approach is to improve the conditions of combustion in such a way that the production of nitrogen oxides in the combustior zone may be minimized. Therefore there has been an increasing demand for the ingenuous burners which may be not only applied to the newly constructed boilers as well as to the existing boilers at less cost but also may satisfactorily reduce the production of nitrogen oxides.

Then one of the objects of the present invention is to provide a burner which not only may satisfy the above requirements but also may permit the control on the conditions of combustion

over a wide range corresponding with the characteristics of the boiler on which is installed the said burner.

Another object of the present invention is to provide a burner which may be so easily controlled on the fuel ignition and extinction process of burner that the automatic and/or remote operation of the burner may become possible.

The present invention will become more apparent from the following description of one preferred embodiment thereof taken in conjunction with the accompanying drawings, in which:-

Fig.1 is a sectional view of a prior art single register-single throat type burner;

Fig.2 is a sectional view of a prior art double register-double throat burner;

Fig.3 is a sectional view of a burner in accordance with the present invention;

Fig.4a is a view used for the explanation of the flow pattern in the prior art burner; and

Fig.4b is a view used for the explanation of the flow pattern in the burner in accordance with the present invention.

Same reference numerals are used to designate similar parts throughout figures.

Prior to the description of the preferred embodiment of the present invention, the prior art burners will be briefly described with reference to Figs.1 and 2 in order to distinctly and specifically point out their problems.

First referring to Fig.1, the single register-single throat burner installed on a furnace wall 1 includes a pulverized-coal burner inner tube 9 and a pulverized-coal burner outer tube 14 for feeding pulverized coal 12 as shown in the upper half, a spud type gas burner 17 for feeding a gas fuel 13 as shown in

the lower half, and a heavy oil burner 15 with a diffuser 16 for feeding a liquid fuel 11 at the center of th burner or burner throat 20. Combustion air 2 is forced to swirl by register van s 5 positioned along the periphery of the burner, and is directed toward the throat 20 in the furnace wall 1 through the space or combustion air passageway defined by a throat ring.7, a register supporting plate 21 and the pulverized-coal burner outer tube 14 and the space defined by the throat ring 7, the register supporting plate 21 and an interior deflector 10.

One of the advantages of the burner of the type described is that it is simple in construction, only the air register vanes 5 are provided in order to control the pattern of the flows of the air as well as the distribution of the velocities of the air flows but the control range is very limited and consequently the range of the control on the shape of the flame is also very narrow. In practice, the shape of the flame must be controlled depending upon the emission of pollutants such as nitrogen oxides, carbon monoxide and paticulate matters and upon the effect of the shape of the flame on the performance of the boiler. Therefore it is desirable that the shape of the flame may be controlled over a wide range. From the standpoint of this flame shape controllability, the prior art burner of the type shown in Fig.1 is not satisfactory because of its narrow or limited flame shape controllability as described above.

In the double register--double throat burner shown in Fig.2, in addition to the air register vanes 5, additional vanes 6 are provided so that the flows 3 and 4 of combustion air may be controlled independently of each other. However the simultaneous control of two sets 5 and 6 of air register vanes for controlling the combustion air flows 3 and 4 is very troublesome

or inconvenient especially on the fuel ignition and extinction process of burners and particularly when a relatively large number f burners are installed. In general, automatic or remote controlled burners are used in the boilers that have been recently constructed or are to be constructed. With the double register-double throat burner of the type described in conjunction with Fig.2, two independent sets of vane drive devices and control wiring systems are required so that the cost is expensive and the burner is complex in construction and consequently low in reliability. In order to overcome these problems, one common drive device may be provided for driving both the air register vanes 5 and 6, but the result would be that two sets 5 and 6 of air register vanes cannot be controlled independently of each other and consequently the range of the control on the shape of the flame will be narrowed. In other words, the arrangement for driving two sets of air register vanes with a common drive device would offset the most advantage of the double register-double throat burner.

In Fig.3 there is shown one preferred embodiment of the present invention which may substantially overcome the above and other problems encountered in the prior art burners. The burner shown in Fig.3 might be seemed similar in construction to the prior art burner shown in Fig.1, but is essentially different in construction and function as will be described below so that novel effects hithereto unattainable by the prior art burners may be attained.

The passageway of combustion air 2 from the vanes 5 to the throat 20 is divided into outer and inner passageways by a partition wall plate 22 and an external deflector plate or ring 8, and the register vanes 6 which can be driven independently of

th vanes 5 are positioned in the inner passageway defined by the register supporting plate 21 and the partition wall plate 22.

In operation combustion air 2 which is pressurized and supplied from a forced draft fan (not shown) or the like is caused to swirl by the vanes 5, and a part of combustion air 3 thus swirled flows toward the throat 20 through an annular passageway defined between the throat ring 7 and the external deflector plate or ring 8. When the remaining part 4 flows into the inner passage defined between the register supporting plate 21 and the partition wall plate 22, it is caused to further swirl by the vanes 6 and flows toward the throat through an annular passage defined between the external deflector plate or ring 8 , and the pulverized coal outer tube 14 (shown in the upper half of Fig.3) and an internal deflector plate 10 (shown in the lower half of Fig.3).. At the throat 20 combustion air 3 flowing through the outer passageway and combustion air 4 flowing through the inner passageway join.

The liquid fuel 11 such as heavy oil is injected through the heavy oil burner 15; the pulverized coal 12 is injected from the nozzle of the pulverized-coal burner consisting of the inner and outer tubes 9 and 14; and the gas fuel is injected through the spud gas burner 17. These fuels may be fired independently of each other or in any suitable combinations.

In summary, the present invention is characterized in that the combustion air passageway downstream of the vanes 5 is divided into the outer and inner passageways, and the vanes 6 are positioned in one of the outer and inner passageways. Therefore instead of arranging the vanes 6 in the inner passageway as shown in Fig.3, they may be installed in the outer combustion

air passageway. In addition, the passageway downstream of the vanes 5 may be divided into more than two passageways.

With the burner in accordance with the present invention, the flow or flow velocity pattern of the combustion air at the throat 20 may be widely varied so that the shape of the flame and other combustion conditions may be controlled depending upon the content of nitrogen oxides and unburned solids in the exhaust gases and the thermal radiation characteristics of the flame.

In Figs.4a and 4b there are shown, respectively, the flow patterns measured at the section X-X of the prior art burner and the burner in accordance with the present invention for the sake of comparison. As seen from Fig.4a, with the prior art burner, the air flow pattern or the distribution of axial velocities of air flows can be controlled or varied only within a very limited range. That is, when the degree of opening of the vanes 5 is increased, the swirling forces or degree of rotation imparted to the combustion air flows are decreased so that the flame tends to lift or blow off. On the other hand, when the degree of opening of the register vanes 5 is decreased, the tendency of flash-back of the flame increases so that the over-heating of burner tiles and excessive temperature rise of water tubes in the vicinity of the burner tiles will happen.

However with the burner in accordance with the present invention, the flow pattern may be varied over a wide range as shown in Fig.4b by controlling the degree of opening of the register vanes 6 with the register vanes 5 set at 45° as in the prior art burners. Moreover, in the burner in accordance with the present invention, it is not necessary to control the degree of opening of the vanes 5 over a wide range so that the lift of the flame as well as the flash-back may be avoided. Thus the

stable combustion may be proceeded by varying the flow pattern. Furthermore in the burner ignition or extinction process, it uffices only to control the vanes 5 so that the control of the register vanes may be much facilitated and consequently the automatic or remote control of the burner may be also facilitated.

The claims defining the invention are as follows :-

1. A burner wherein a combustion air passageway from a first set of register vanes to a burner throat is divided into outer and inner passageways;

and a second set of register vanes controllable independently of said first set of register vanes are disposed in said outer or inner passageways.

2. A burner as set forth in Claim 1 wherein pulverized coal, a gas fuel and a liquid fuel are independently burned or in any suitable combinations thereof.

3. A burner as set forth in Claim 1 wherein said first and second sets of register vanes are automatically or remote controlled.

DATED: 15th September, 1977.

PHILLIPS ORMONDE AND FITZPATRICK
Attorneys for :-
ISHIKAWAJIMA-HARIMA JUKOGYO KABUSHIKI KAISHA

Fig. 1

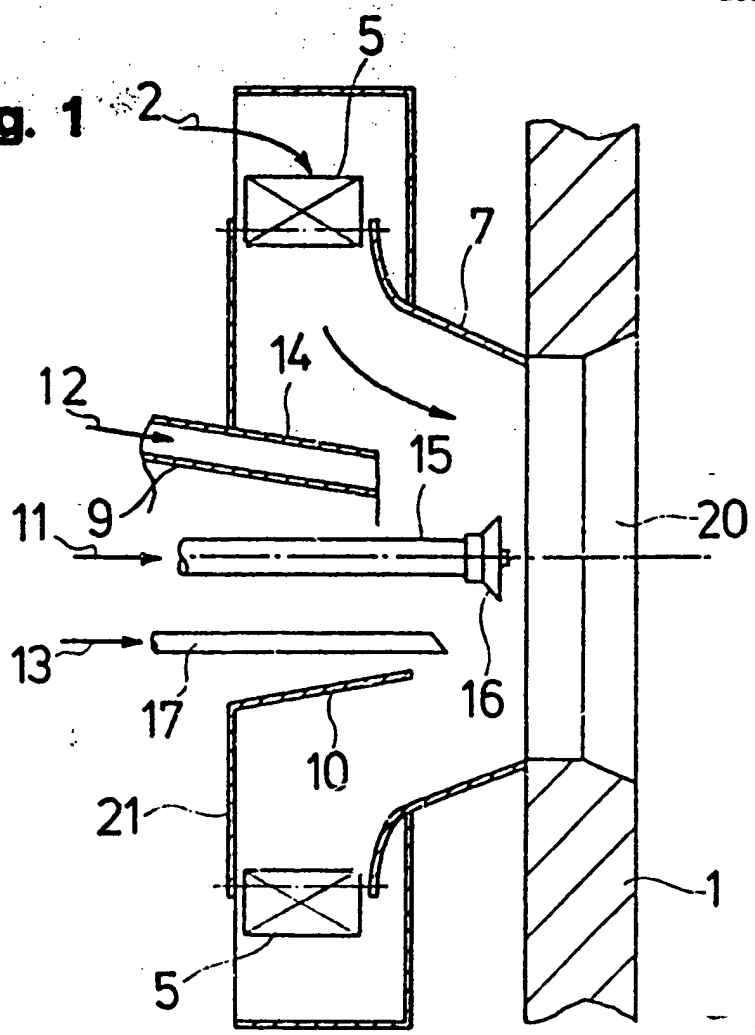


Fig. 2

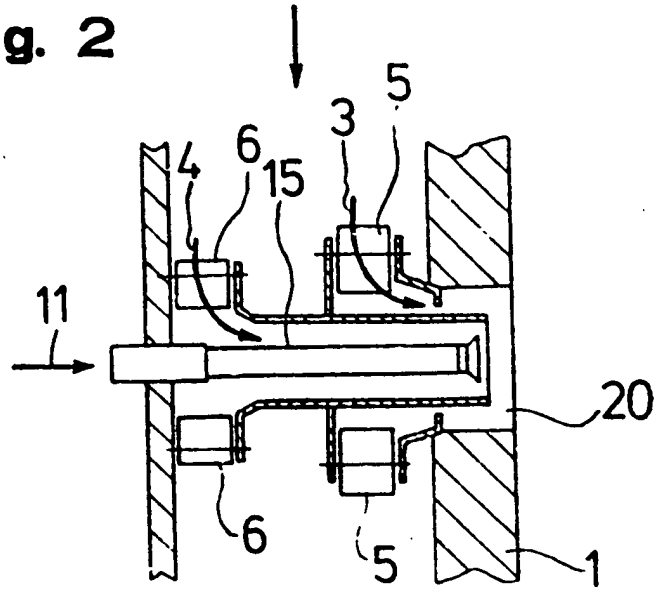


Fig. 3

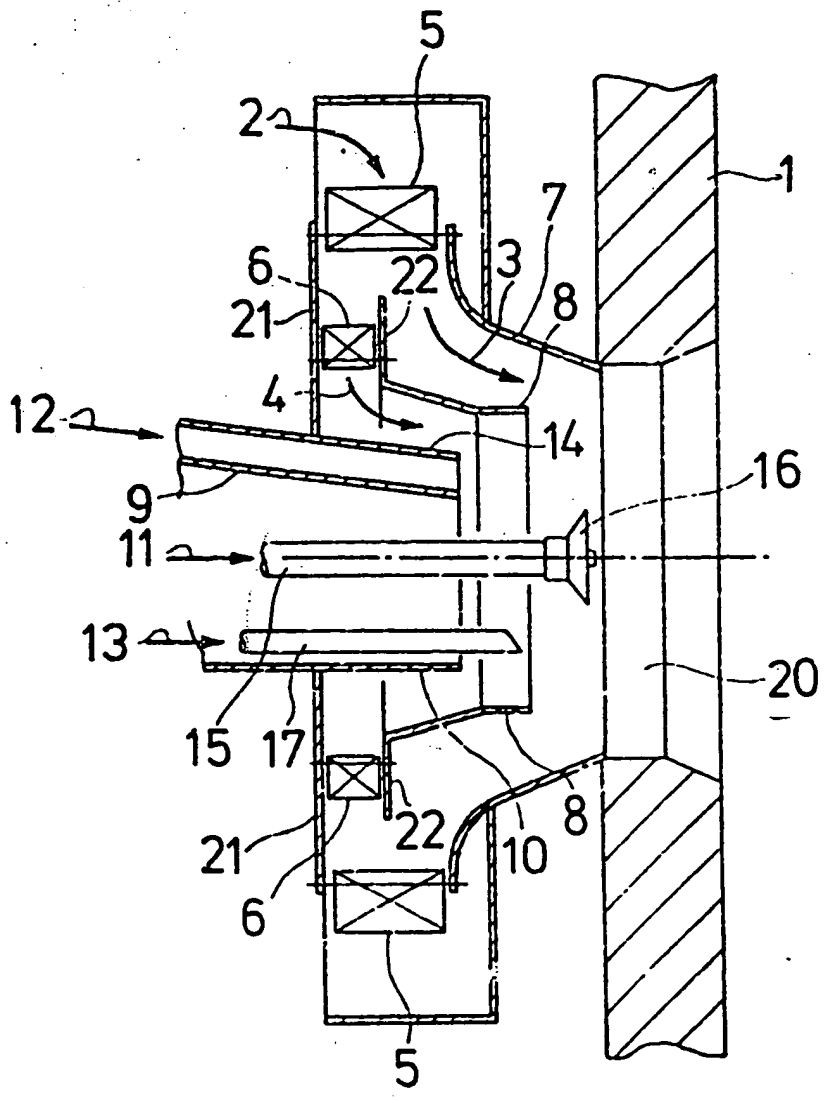
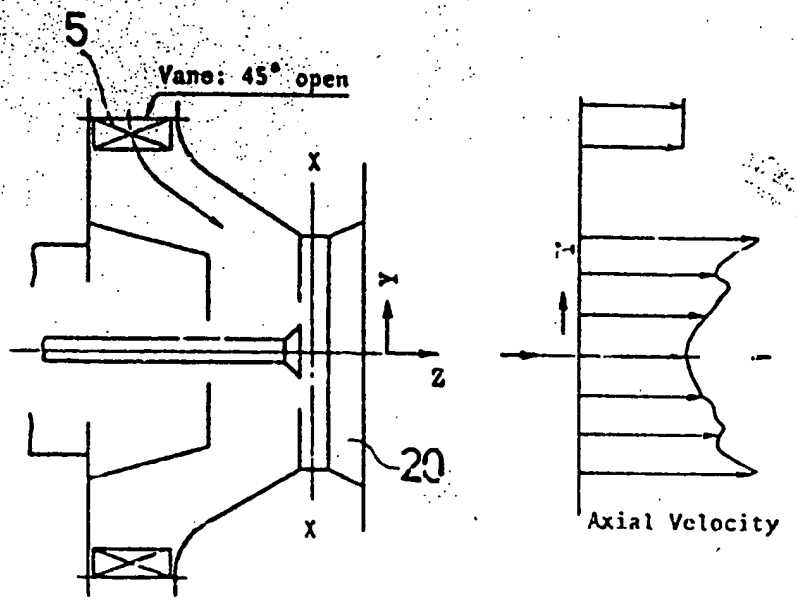
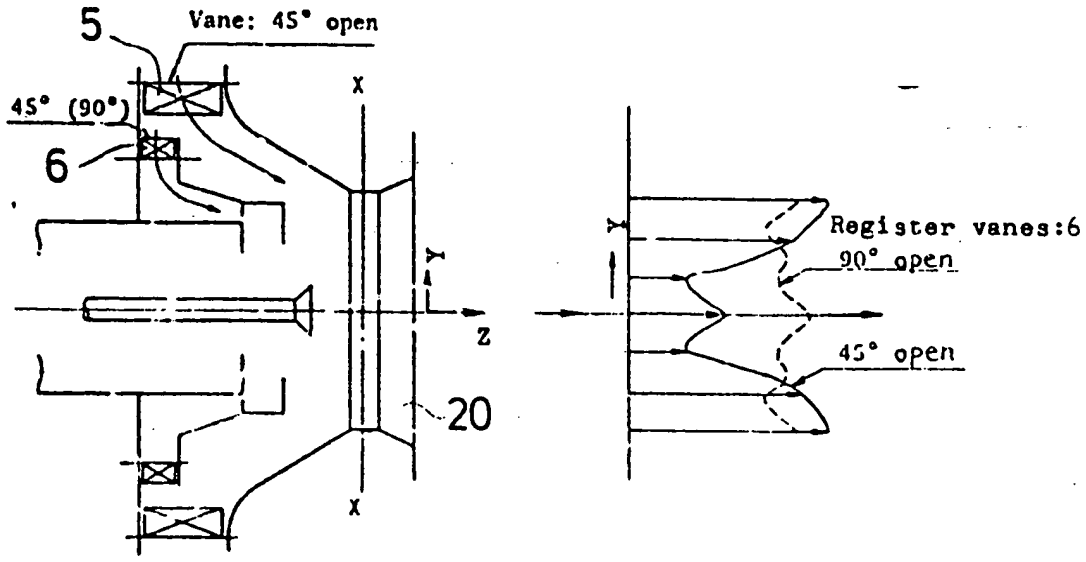


Fig. 4a



PRIOR ART

Fig. 4b



PRESENT INVENTION